

Low Power FPGA Based Spectrometer, Phase I

Completed Technology Project (2007 - 2007)



Project Introduction

We propose to design a general purpose reconfigurable wide bandwidth spectrometer for use in NASA's passive microwave missions, deep space network and radio astronomy. In Phase I, we will design and build a low power, low cost real time FPGA based spectrometer board that will analyze a 3 GHz bandwidth signal with 16,384 channels. Utilizing 3 Gsample/sec 8 bit ADC's and Xilinx Virtex 4 FPGA's, the proposed spectrometer can also be configured to analyze a pair of signals with 1.5 GHz bandwidth each, or four signals of 750 MHz bandwidth each. A Polyphase Filter Bank (PFB) will be implemented instead of a large FFT, because the PFB has excellent out of band rejection (> 80 dB), preventing strong RFI from contaminating adjacent bands. In Phase II, we will space qualify the spectrometer, provide significantly higher bandwidth capabilities, and add high speed output, and consider an ASIC implementation for lower-power space-based applications. Technological instrumentation has flown on Rosetta, PERSI, and several sounding rockets.

Anticipated Benefits

Potential NASA Commercial Applications: We will make the Phase I low cost spectrometer available to the radio astronomy community for a wide variety of applications, including multibeam spectroscopy (eg: HEAT, MAS), holography, IR and sub-mm heterodyne spectroscopy, CMB resonating bolometer experiments, and small educational radio telescopes at high schools and universities. The phase II spectrometer with 10GBe/infiniband outputs can be used for beam forming, pulsar timing and searching, reionization experiments, adaptive RFI mitigation, very long base line interferometry (Mark 5C VLBI for geodesy and astronomy), and large imaging correlators such as those needed for SKA, ATA, LOFAR, LWA, PAST and transient searches.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

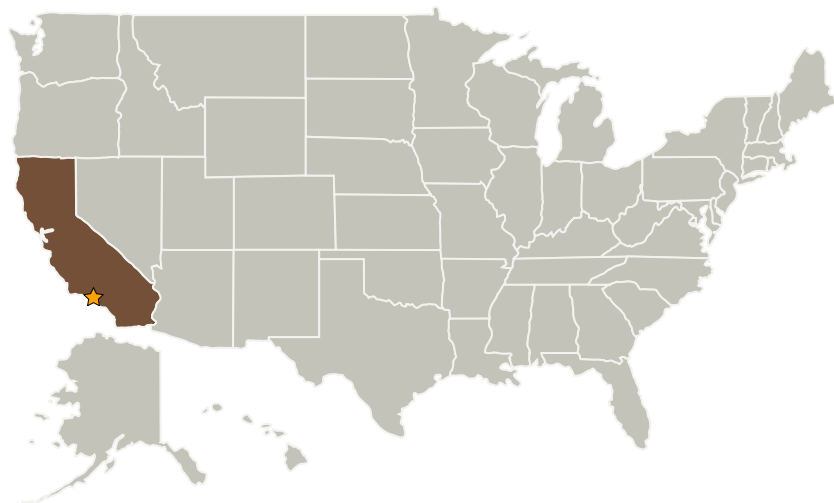
Small Business Innovation Research/Small Business Tech Transfer

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Jet Propulsion Laboratory (JPL)	Lead Organization	NASA Center	Pasadena, California
Techne Instruments, Inc.	Supporting Organization	Industry	Oakland, California

Primary U.S. Work Locations

California

Project Transitions

**January 2007:** Project Start**July 2007:** Closed out**Closeout Summary:** Low Power FPGA Based Spectrometer, Phase I Project Image

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Richard Raffanti

Technology Areas

Primary:

- TX02 Flight Computing and Avionics
 - └ TX02.2 Avionics Systems and Subsystems
 - └ TX02.2.6 Data Acquisition Systems